

New Automobiles and Parts

$$EC/N = -0.456 + 0.140 YT + 0.114 YP - 0.015 (YP \times cc)$$

(4.85) (3.67) (6.13) (0.77)

$$-0.307 CSTACK_{t-1} - 0.027 DBT + 0.014 ASF$$

(3.68) (2.52) (5.81)

R-bar2: .689 Durbin-Watson: 0.992

Sample period: 1965:1--1985:3

Other Consumer Durables

$$EO/N = -0.871 + 0.147 YT + 0.148 YP - 0.101 (YP \times co)$$

(9.04) (3.55) (12.88) (4.43)

$$-0.042 OSTACK_{t-1} + 0.084 DBT + 0.006 ASF$$

(1.28) (3.48) (1.78)

R-bar2: .981 Durbin-Watson: 0.598

Sample period: 1965:1-1985:3

Definitions:

EC: Consumer durable spending on new autos (MPS).

EO: Consumer durable spending on goods excluding new autos (MPS).

N: Population (MPS).

YT: Transitory disposable personal income (see footnote 19).

YP: Permanent disposable personal income (see footnote 19).

cc: User cost for consumer automobiles (dollars per dollar; incorporates nominal rather than real interest rate).

co: User cost for consumer durables other than automobiles (dollars per dollar; incorporates nominal rather than real interest rate).

CSTACK: Stock of consumer autos (MPS).

OSTOCK: Stock of consumer durables other than autos (MPS).

DBT: Gross real per capita financial liabilities of household sector (FF).

ASF: Real gross per capita financial assets of household sector (FF).

Nondurable Consumption

The tax legislation may affect nondurable consumption in a variety of ways. Several features of it affect the after-tax return to capital and may therefore affect the saving rate. Apart from the effects of changes in effective marginal tax rates, the significant reduction in the average individual income tax rate will increase disposable incomes for many and

thus may increase both their spending and their saving. There is an offset to this effect in the short run, however, in that the increase in corporate tax liabilities implied by the act causes a reduction in income and wealth for individual stockholders.

Overall Effective Marginal Tax Rates. A complication in judging how saving may be affected by changes in the after-tax rate of return comes about because the change in the after-tax return itself is ambiguous: the legislation reduces marginal individual income tax rates, but it increases the corporate tax rate. As a result, most estimates suggest that the Tax Reform Act increases the overall effective marginal tax rate on income accruing to individuals from investments in corporate assets.

Regardless of the answer to the question of how much the after-tax rate of return is changed by the tax law, the econometric literature is ambiguous as to whether any such change will have an effect on saving. Most recent studies of the consumption function have failed to find significant after-tax interest-rate effects on saving, although some dissent from this view. ^{20/}

Capital-Gains Tax Changes. Even though the increase in capital-gains tax rates under the act is most directly an individual income tax provision, it could reduce corporate saving. Under the old tax law, some corporations had an incentive to retain earnings (taxed at the shareholder level at the relatively low capital-gains rate) rather than pay dividends (taxed at a higher rate). Corporate finance theory implies that only those firms whose equity was undervalued in the market had an incentive to pay dividends. ^{21/} The undervaluation of their stock implied a reduced return to the stockholder from retentions, before and after taxes. In equilibrium, this after-tax return equalled the reduced after-tax return from dividend payouts entailed by their higher tax rate. The new law nearly equalizes the tax rates on capital gains and other forms of income. This should mean that more corporations should be indifferent between paying out dividends and retaining earnings than was true before, so more should pay dividends.

Thus there might be a reduction in corporate saving after the tax change. This would reduce total saving unless shareholders offset the reduction with an increase in their own saving. Stockholders might increase their saving if they see through the corporate veil and realize how corporate financial policy affects the value of their own assets. If stockholders are

20. Prominent among the dissenting empirical studies is Lawrence Summers, "Tax Policy, the Rate of Return, and Savings," National Bureau of Economic Research Working Paper 995 (September 1982).

21. Alan J. Auerbach, "Share Valuation and Corporate Equity Policy," *Journal of Public Economics* (1979), pp. 291-305.

not that sophisticated, however, the change in business saving could reduce overall saving. 22/

Disposable Income Effects. While the factors just described seem likely to have some effect on consumption and saving, the dominant effect is likely to be that related to the changes in permanent disposable income implied for households by the act. The changes in individual and corporation income tax revenues that are relevant to this question are shown in Table 3. 23/

As the table shows, individuals receive a direct tax cut concentrated in fiscal 1988 and 1989, while corporations face a tax increase of roughly equal cumulative magnitude (over five years) distributed uniformly over the years shown. According to the general lifecycle/permanent income model of consumption, permanent income and consumption should be increased by the permanent component of the individual income tax cut, while consumption should be reduced by the corporate tax increase through its effects on financial wealth. The net effect on consumption depends on relative propensities to spend out of the different components of wealth that are affected by the tax change. 24/

In order to estimate these effects, this study uses the nondurable consumption equation of the MPS econometric model--a life-cycle equation. This formulation incorporates separate distributed lags on four income flows--after-tax labor income, transfers, after-tax taxable property income,

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22. Tax reform affects the after-tax return to saving in another way because the act curtails access to individual retirement accounts (IRAs). A recent paper by Venti and Wise adduces empirical evidence based on cross-sectional survey data from 1982 and 1983 implying that such reductions in the limit on IRA contributions might reduce saving. Steven F. Venti, and David A. Wise, "Tax-Deferred Accounts, Constrained Choice, and Estimation of Individual Saving," *Review of Economic Studies* (August 1986), pp. 579-601.
23. Many state and local governments that "piggyback"--that is, use the federal income tax bases under their own income taxes--have said that they plan to keep their tax rates unchanged and thus to collect more revenue after the federal tax base is broadened. This could at least partially offset the changes in permanent household income that are implied by the change in federal tax liabilities. It is assumed in this study, however, either that state and local tax rates will be reduced to give the piggybacking windfall back to taxpayers, or that state and local government spending will rise in roughly equal proportion. Accordingly, the estimates of the tax effect on consumption (and hence on aggregate demand) that are shown below ignore the piggybacking effect.
24. As this discussion suggests, the neocardian proposition that tax changes have zero consumption impacts is obviated by this analysis to the extent that the tax reform act is really revenue neutral. The anticipated offsetting tax change that finances any single tax change is already accounted for within this analysis. For an exposition of the neocardian view, see Robert Barro, "Are Government Bonds Net Wealth?", *Journal of Political Economy* (1974).

and nontaxable property income. The values of three components of the stock of household wealth enter as well: household stock, other financial wealth, and real household assets. The average tax rates that are involved in converting taxable income flows to after-tax terms enter separately with their own distributed lags (not shown in the equation listing below). Like the lags on the income flows, these lag distributions model the formation of expectations regarding the permanent values of the corresponding variables. The estimated equation is:

$$\begin{aligned} \text{CON/N} = & (1-T) \times 0.418^{**}\text{YL/N} + 1.053^{*}\text{YTR/N} + \\ & (1-T) \times 0.489^{***}\text{YPR1/N} + 0.489^{***}\text{YPR2/N} + \\ & 0.049^{**}\text{VST/N} + 0.148^{****}\text{VCNF/N} + 0.082\text{VCNR/N} - \\ & 0.043\text{JOIL} \end{aligned}$$

This equation is not estimated for this study, but rather is taken directly from the MPS econometric model.

*Variable is entered as a 5-quarter distributed lag, fit to a second-degree polynomial with far endpoint constraint. Reported coefficient is the sum of the lag coefficients.

**Variable is entered as a 6-quarter distributed lag, fit to a second-degree polynomial with far endpoint constraint. Reported coefficient is the sum of the lag coefficients.

***Variable is entered as a 6-quarter distributed lag, fit to a second-degree polynomial with near and far endpoint constraints. Reported coefficient is the sum of the lag coefficients.

****Variable is entered as a 12-quarter distributed lag, fit to a second-degree polynomial with near and far endpoint constraints. Reported coefficient is the sum of the lag coefficients.

Definitions:

CON: Nondurable consumption.

N: Population.

YL: Labor income.

YTR: Transfer income.

YPR1: Taxable property income.

YPR2: Nontaxable property income.

VST: Value of common stock (nominal).

VCNF: Financial assets in household net worth.

VCNR: Real assets in household net worth.

JOIL: Oil shock dummy.

T: Estimated average federal and state and local individual income tax rate.

The marginal (and average) propensities to consume out of permanent incomes suggested by the equation are between 40 and 50 percent except for transfers, where the propensity exceeds unity. These marginal propensities (other than that for transfers) are strikingly low relative to earlier estimates. The propensities to consume out of wealth are between 5 and 15 percent.

In modeling the consumption impacts of the Tax Reform Act, the individual income tax rate was reduced year by year by the amount implied by the figures in the first column of Table 3, and the flow of taxable property income was reduced by the full amount of the corporate tax increase in the second column. Correspondingly, the value of stock holdings was reduced by this same figure after it was capitalized using the MPS capitalization equation. The assumptions regarding the timing of changes in income expectations are discussed further below.

Interest-Rate Impacts

Many analysts expect the Tax Reform Act to affect interest rates. One common view is based on the premise that rates are closely related in equilibrium to the after-tax return to capital. According to this view, rates should fall after implementation of tax reform, given that the act increases the effective marginal tax rate on capital income. This is a likely long-run effect of the tax change, and as such it is discussed in some detail in the next section of this paper.

TABLE 3. CHANGES IN REVENUES FROM INDIVIDUAL AND CORPORATION INCOME TAXES IMPLIED BY THE TAX REFORM ACT (In fiscal years and in billions of dollars).

Year	Individual	Corporation
1987	-14.0	25.2
1988	-41.0	23.9
1989	-37.9	22.5
1990	-15.6	23.4
1991	-13.5	25.2
Five-year Total	-122.0	120.2

SOURCE: Joint Committee on Taxation.

In the short run, by contrast, the strongest effect on interest rates is likely to come through increases or decreases in the demand for money that are consequent upon the overall changes in the demand for goods and services that are caused by the tax change. In order to estimate interest-rate impacts coming about through this channel, this study assumes that the Federal Reserve will hold the path of the monetary aggregate M2 fixed during the 1986-1988 period over which the tax bill is implemented, in accordance with stated Federal Reserve policy. ^{25/} Accordingly, estimates of the interest-rate impacts in the calculations below were made using the following estimated equation for the demand for M2:

$$\log(M/N) = -0.526 + 1.053 * \log(GNP/N) - 0.032 * OPP$$

R-bar2: .997 Durbin-Watson: 0.508

Sample period: 1977:1--1985:4

*Variable is entered as a 5-quarter distributed lag, fitted to a second-degree Shiller lag. Reported coefficient is the sum of the lag coefficients.

Definitions:

M: M2 (MPS).

N: Population (MPS)

GNP: Nominal GNP (MPS)

OPP: Estimated opportunity cost of holding M2, defined as the 91-day Treasury-bill rate minus a weighted average of yields available on components of M2.

This equation relates M2 demand to GNP with a long-run income elasticity of approximately one, and to an estimate of the average opportunity cost of holding M2 in terms of forgone interest income, which enters with a negative coefficient. ^{26/} The change in the short-term market interest rate needed to maintain equality between the supply and demand for money is calculated using this equation and the identity defining the opportunity-cost variable.

25. Statement by Paul A. Volcker, Chairman, Board of Governors of the Federal Reserve System, before the Committee on Banking, Housing, and Urban Affairs, United States Senate, July 23, 1986.

26. The equation was estimated by two-stage least squares: the contemporaneous observation on OPP was instrumented by a constant, the (Federal Reserve Bank of New York) discount rate, nonborrowed reserves, and four lagged values of OPP, and four lagged values of per capita GNP.

Net Exports

The Tax Reform Act might affect U.S. real net exports. Net exports could be reduced if the tax change increased the prices of U.S. goods without an offsetting adjustment in the exchange rate. A significant change in U.S. prices seems unlikely, however, as the discussion below suggests. Another effect on net exports could come about if the tax change stimulated a flow of capital between this country and the rest of the world that affected the exchange rate and with it the relative dollar prices of foreign and domestic commodities.

The strongest short-run impact on net exports seems likely, however, to be indirect, working through the changes in the demand for imports that are implied by the overall impact of the tax change on aggregate demand. In order to estimate the effect, this study borrows an import equation from the Fair model of the U.S. economy. ^{27/} This equation expresses real imports of goods and services as a function of GNP, interest rates, and the average price levels for domestic and imported goods. The equation is

$$\begin{aligned}
 (IM/N) = & -0.0930 + 0.761 (IM_{t-1}/N_{t-1}) + 0.0444(Y/N) - 0.0820 PIM_{t-1} \\
 & (4.13) \quad (16.24) \quad (4.57) \quad (2.70) \\
 & + 0.201 PX_{t-1} - 0.00523 RMA + \dots \\
 & (4.88) \quad (3.30)
 \end{aligned}$$

R2: .9909 Durbin-Watson: 1.79

Sample period: 1954:1--1985:4

Definitions:

IM: Imports of goods and services.

N: Population.

Y: Domestic demand.

PIM: Price deflator for imports.

PX: Price deflator for domestic demand.

RMA: After-tax mortgage rate.

...: The equation as estimated also included several dummy variables to account for dock strikes in the United States.

27. Ray C. Fair, *Specification, Estimation, and Analysis of Macroeconometric Models* (Harvard University Press, 1984).

Possible Labor-Supply Responses

Recent economic research has suggested that the reduced marginal individual income tax rates may significantly increase the desire to work among secondary earners. ^{28/} This opens the possibility that the Tax Reform Act may stimulate an increase in labor supply and consequently perhaps in GNP.

Such an outcome seems unlikely, however. One reason is that the act does away with the second-earner deduction (marriage penalty relief) that existed previously, which has the effect of increasing marginal tax rates on secondary workers. In any case, it appears that reductions in marginal rates entailed by the Tax Reform Act will be quite small for most taxpayers. There will be large apparent reductions in marginal rates for high-income taxpayers, but these account for a relatively small percentage of the total. The average reductions in marginal tax rates for wage earners (that is, reductions weighted by the percentages of taxpaying wage earners who are affected) are quite small: 2.3 percentage points in 1987 and 3.2 in 1988. ^{29/}

Possible Price Responses

The analysis in this section assumes that the paths of all prices are unaffected by the implementation of the Tax Reform Act. All the demand responses in the modeling exercise below are assumed to give rise to equivalent changes in real output rather than to changes in the price level--an assumption based on the relatively high amount of excess capacity in the economy presently and the relatively small GNP effects of the tax legislation.

Similarly, the various effects of the tax change on the cost of production and consequently on the price level are assumed to offset each other and result in no net effect. On the one hand, the reduction in individual income tax rates might reduce wage demands in collective-bargaining sessions, either directly or through a possible increase in labor supply among secondary workers. On the other hand, an increase in the effective tax rate on capital income might cause corporations to raise the prices of their products in order to try to pass the increase in their costs along to consumers.

28. Jerry Hausman, "Labor Supply," in Joseph A. Pechman and Henry Aaron, eds., *How Taxes Affect Economic Behavior* (Brookings Institution, 1984).

29. "Preliminary Analyses of Tax Reform Provisions," Congressional Budget Office internal memorandum, September 15, 1986.

Transition Rules

The analysis in this section does not take adequate account of the effects of the "transition rules" involved in the Tax Reform Act. The act contains many special rules providing exceptions for particular industries and areas to the broad terms it sets out. These are too numerous and complicated to be included in the analysis here, but they could significantly increase the overall stimulus from the act by reducing negative impacts on business investment.

THE ECONOMETRIC MODEL

Estimates of the economic effects of the Tax Reform Act are made by treating the eight behavioral equations described above (together with a number of identities that are shown in the appendix) as a small simultaneous econometric model. The model was used to compute changes in GNP and its components, as well as in the interest rate, during the 1986-1988 period. In the tables below, these are expressed as percentages of "baseline" GNP - GNP as forecasted by CBO in the fall of 1986.

These equations were used instead of an established econometric model for several reasons. One is that these equations were developed taking tax factors more carefully into account than is typically true with larger models. Another reason was that each of the three alternative investment models that were used in forecasting could easily be embedded in the simple model constructed here, while with larger econometric models this would have been more difficult. Many analysts, in any case, mistrust results from large models because they fear that their simulation results are affected by the complexity that necessarily accompanies increases in model size.

There are, of course, drawbacks from using a relatively small model such as the one employed in this section. The most obvious one is that important aspects of the response of the economy to tax reform may be left out.

The Timing of Tax Effects. The repeal of the investment tax credit is assumed to have begun to have its effect on January 1, 1986, in spite of the fact that it was not enacted until late October of that year. This assumption reflects the fact that all versions of tax reform since the House bill passed in late 1985 entailed well-publicized provisions to repeal the investment tax credit effective on January 1, 1986, retroactively if necessary.

Individual income tax rates are cut by the act in two stages: one on January 1, 1987, and the other a year later. Another change in disposable personal income is implied by increases in corporation income tax liabilities

that are caused by the act. These changes are assumed to take effect when the underlying tax changes become effective: on January 1, 1986, January 1, 1987, and July 1, 1987.

It is possible that expectations about permanent disposable income changed in response to the tax cut as early as the beginning of 1986 (or perhaps even earlier), when passage of the (widely-publicized) tax bill became highly probable. If this happened, the effects of the act on consumption might have been felt at the same time. In this study, however, it is assumed that expected disposable income changed at the same time that the underlying changes in individual or corporate tax rates were implemented. This assumption is made because most of those receiving tax cuts are relatively low-income households that might not be so sophisticated as to formulate forecasts of disposable income months in advance. In any case, the tax cut for consumers as a whole implied by the act is small enough that the analysis is not effected substantially by changes in assumptions about timing.

Economic Impacts

Tables 4-9 below show estimated impacts of the tax legislation on business investment, housing, consumption, output, and interest rates using three alternative models of business investment. Separate figures are given in Tables 4, 6, and 8 for the direct or "static" effects of the tax change--those that leave interactions among sectors and multiplier effects out of account and in Tables 5, 7, and 9 for the overall effects. Tables 4 and 5 show the direct and overall impacts of the tax change using the accelerator formulation for business investment. Tables 6 and 7 show results from the modified Bischoff putty-clay formulation, and tables 8 and 9 show results from the Hall-Jorgenson putty-putty approach.

The impact on business investment depends heavily on the investment submodel that is chosen. In the accelerator results, the Tax Reform Act has no direct effect; and even in the putty-clay results it is barely perceptible (but concentrated in producers' durable equipment). Even the indirect effects in these models are quite small, but they are positive and growing in magnitude by late 1988 when the calculations end. In the putty-putty figures in Tables 8 and 9, by contrast, the act has a strong negative impact, again concentrated in equipment investment. The depressing effect on investment reaches a peak in early 1987 and diminishes steadily after that.

As all the tables show, the tax cut for individuals has a noticeable effect in stimulating consumption spending for both durable and nondurable goods, especially after the beginning of 1988. There is net stimulus to

spending on consumer durables in spite of the fact that the user cost for consumer durables increases with the reductions in individual income tax rates that take effect then: the stimulus from increased disposable income more than offsets the restraining effect of increased user costs. The bill has a depressing effect on residential investment that begins to be felt at the beginning of 1987 when the scaled-back depreciation allowances for commercial housing and reduced individual and corporate income tax rates take effect.

The sharp reduction in GNP in the putty-putty results induces a decline in imports (which decline because they depend on domestic demand, which depends on GNP). This is the only case in all the solutions in which imports are affected noticeably by tax reform.

Overall Effects. The GNP impacts of all these changes taken together are relatively slight except in the putty-putty-based model. In the accelerator and putty-clay models, there is little discernible GNP impact in 1986. In 1987, the negative effects on housing are sufficient to make the overall GNP impact slightly negative. Only in 1988 does a noticeable positive impact on GNP emerge as growth in durable and nondurable consumption finally begins to exceed negative effects in other sectors and lead to a noticeable rise in GNP. This GNP increase is growing in magnitude as the calculations end in the last quarter of 1988.

In the putty-putty-based model, the story is somewhat more pessimistic. The shortfall in business investment caused by the act is so strong in this model as to bring about a significant reduction in GNP relative to the baseline during 1986, 1987, and early 1988. The shortfall peaks at just over 1 percent of baseline GNP in the third quarter of 1987. The reduction in investment dies out rapidly late in 1988, however. This should make it possible for the sustained increases in durable and nondurable consumption to increase GNP after the forecast period; in fact the overall GNP effect is growing and just turning positive at the end of 1988.

Interest Rates and Monetary Policy. Interest rates are affected only slightly in the accelerator- and putty-clay-based models: they are bid upward by about a tenth of a percentage point late in 1988 by the positive GNP impacts that emerge then. In the putty-putty-based model, by contrast, rates are pulled downward by the GNP reductions by as much as two-tenths of a percentage point during 1987.

The figures above were calculated assuming that Federal Reserve policy is to keep the path of M2 at its previously announced targets after implementation of the Tax Reform Act. If the central bank were instead assumed to allow M2 to grow more strongly, interest rates in this model would rise less or would fall, GNP would grow more, and business investment and housing would fall less or would expand more strongly. The impact of lower interest rates would be concentrated in housing and in business investment in structures rather than in equipment, because the user cost of structures is more sensitive to changes in the interest rate.

TABLE 4. ESTIMATED DIRECT SPENDING IMPACTS OF TAX REFORM USING ACCELERATOR INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int ^a	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.1	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1987:4	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1988:1	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:2	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:3	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:4	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

TABLE 5. ESTIMATED OVERALL ECONOMIC IMPACTS OF
TAX REFORM USING ACCELERATOR INVEST-
MENT EQUATIONS (In percent of baseline
real GNP unless otherwise noted)

Quarter	GNP	Int ^{a/}	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.1	0.0	0.1	0.0	0.0	-0.3	0.0	0.0	0.0
1987:4	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1988:1	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:2	0.3	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:3	0.3	0.1	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:4	0.3	0.1	0.4	0.1	0.1	-0.4	0.1	0.0	0.0

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

TABLE 6. ESTIMATED DIRECT ECONOMIC IMPACTS OF TAX REFORM USING PUTTY-CLAY INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int ^{a/}	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1987:4	-0.2	0.0	0.1	0.0	0.0	-0.4	0.0	0.0	0.0
1988:1	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:2	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:3	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0
1988:4	0.1	0.0	0.4	0.1	0.1	-0.5	0.0	0.0	0.0

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

TABLE 7. ESTIMATED OVERALL ECONOMIC IMPACTS OF
TAX REFORM USING PUTTY-CLAY INVEST-
MENT EQUATIONS (In percent of baseline
real GNP unless otherwise noted)

Quarter	GNP	Int ^a /	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986:4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987:1	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1987:2	0.0	0.0	0.1	0.0	0.0	-0.2	0.0	0.0	0.0
1987:3	-0.1	0.0	0.1	0.0	0.0	-0.3	0.0	0.0	0.0
1988:1	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:2	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:3	0.2	0.0	0.4	0.1	0.1	-0.4	0.0	0.0	0.0
1988:4	0.2	0.0	0.4	0.1	0.1	-0.3	0.1	0.0	0.0

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

TABLE 8. ESTIMATED DIRECT ECONOMIC IMPACTS OF TAX REFORM USING PUTTY-PUTTY INVESTMENT EQUATIONS (In percent of baseline real GNP unless otherwise noted)

Quarter	GNP	Int ^{a/}	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0
1986:2	-0.6	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	0.0
1986:3	-0.9	0.0	0.0	0.0	0.0	0.0	-0.9	0.0	0.0
1986:4	-1.0	0.0	0.0	0.0	0.0	0.0	-1.1	0.0	0.0
1987:1	-0.9	0.0	0.1	0.0	0.0	-0.1	-1.2	0.0	0.0
1987:2	-1.1	0.0	0.1	0.0	0.0	-0.2	-1.3	0.0	0.0
1987:3	-1.2	0.0	0.1	0.0	0.0	-0.3	-1.2	0.0	0.0
1987:4	-1.2	0.0	0.1	0.0	0.0	-0.4	-1.1	0.0	0.0
1988:1	-0.7	0.0	0.4	0.1	0.1	-0.4	-1.0	0.0	0.0
1988:2	-0.5	0.0	0.4	0.1	0.1	-0.5	-0.8	0.0	0.0
1988:3	-0.4	0.0	0.4	0.1	0.1	-0.5	-0.6	0.0	0.0
1988:4	-0.2	0.0	0.4	0.1	0.1	-0.5	-0.4	0.0	0.0

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

TABLE 9. ESTIMATED OVERALL ECONOMIC IMPACTS OF
TAX REFORM USING PUTTY-PUTTY INVEST-
MENT EQUATIONS (In percent of baseline
real GNP unless otherwise noted)

Quarter	GNP	Int ^{a/}	Cons	Cars	OCD	Hous	PDE	NRST	Imp
1986:1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0
1986:2	-0.6	-0.1	0.0	0.0	0.0	0.0	-0.6	0.0	0.0
1986:3	-0.8	-0.2	0.0	0.0	0.0	0.1	-0.9	0.0	-0.1
1986:4	-0.9	-0.2	0.0	0.0	0.0	0.1	-1.1	0.0	-0.1
1987:1	-0.8	-0.2	0.1	0.0	0.0	0.0	-1.2	0.1	-0.1
1987:2	-0.9	-0.2	0.2	0.0	0.0	-0.1	-1.3	0.1	-0.1
1987:3	-1.1	-0.2	0.2	0.0	0.0	-0.2	-1.1	0.0	-0.1
1987:4	-1.0	-0.2	0.2	0.0	0.0	-0.3	-1.1	0.0	-0.1
1988:1	-0.5	-0.1	0.4	0.1	0.1	-0.3	-1.0	0.0	-0.1
1988:2	-0.3	-0.1	0.4	0.1	0.1	-0.3	-0.8	0.0	-0.1
1988:3	-0.2	0.0	0.4	0.1	0.1	-0.3	-0.6	0.0	-0.1
1988:4	0.0	0.0	0.4	0.1	0.1	-0.3	-0.4	0.0	-0.1

a. Percentage points.

Details may not add to totals because of rounding.

"GNP" is gross national product.

"Int" is the interest rate (91-day Treasury bill rate).

"Cons" is spending for nondurable consumption.

"Cars" is consumer spending for automobiles and parts.

"OCD" is consumer spending for durable goods other than autos and parts.

"Hous" is residential investment.

"PDE" is investment in producers' durable equipment.

"NRST" is investment in nonresidential structures.

"Imp" is imports of goods and services.

SECTION III

LONG-RUN ECONOMIC IMPACTS OF THE TAX REFORM ACT

This section describes some of the ultimate economic effects of the Tax Reform Act and develops estimates of their magnitudes. In particular, the discussion focuses on the promise of the legislation to improve domestic output as a result of better allocation of investment among assets, by increasing the evenness or "neutrality" with which different types of capital are taxed. Greater neutrality, and the associated increases in output, are among the most prominent reasons why many consider that act a significant improvement in tax policy.

This study takes a relatively simple approach to estimating the output gains from tax neutrality--using estimates of the change in effective tax rates on six different types of productive physical capital to see how much of a gain in potential output can be realized from the consequent near-equalization of the productivities of these types of capital. This is done in the context of a neoclassical growth model. It should be borne in mind, however, that other ways in which the Tax Reform Act contributes to neutrality--such as its more nearly equal treatment of different financing instruments, or its effects in redistributing the capital stock among sectors and industries--are left out of this analysis. Some of these have been dealt with in other papers. ^{30/} Also, the paper takes no account of the fact that the act preserves the relatively low tax rate on owner-occupied housing--an important nonneutrality. For this reason, the figures below may overstate the output gains from reform.

Although they stem from a relatively simple model, and are therefore preliminary, the estimates developed in this paper suggest that the output improvements from improved tax neutrality may be small--perhaps one-tenth to two-tenths of 1 percent of present potential output. At the same time, the results suggest that there could be a reduction in U.S. interest rates on the order of one-tenth of a percentage point.

30. In particular, see Harvey Galper, Robert Lucke, and Eric Toder, "The Economic Effects of the Tax Reform Act of 1986: Simulations with a General Equilibrium Model," paper presented to the Brookings Tax Conference, October 30-31, 1986.

Among the consequences of a possible reduction in interest rates is that it might reduce the net inflow of capital from other countries. This would have the effect of reducing domestic capital and production in the U.S. relative to what it otherwise would have been while effecting an offsetting increase in net claims on production abroad. This shift might have the effect of reducing the growth of worker productivity and wages, which depend in part on the amount of domestic capital.

THE SIMPLE (LONG-RUN) ECONOMICS OF TAX REFORM

How will the economy be affected in the long run by the changes in taxation implied by the Tax Reform Act? This section uses simple graphs to describe several effects. Attention focuses on the impacts of changes in effective marginal tax rates on income from capital. The act also changes marginal tax rates on labor income but, as the discussion above pointed out, the effects of these changes seem likely to be relatively small.

Effects of an Increase in Overall Capital Income Taxation

The Tax Reform Act causes an increase in the overall effective marginal tax rate on the income from capital, and it makes the effective marginal rates on different types of capital, such as equipment and structures, more nearly equal. This is shown in estimates of effective marginal rates before and after implementation of the law, such as those in Table 10.

Interest-Rate and Capital-Allocation Effects

Simple analysis suggests that an increase in the overall effective marginal rate of capital income taxation such as that implied by the Tax Reform Act is likely to lead to a reduction in real interest rates. This is illustrated in Figure 5. The curve marked D is the demand curve for capital (which is the before-tax marginal product function, net of depreciation) graphed as a function of the capital/labor ratio. The supply of capital from saving is shown as the curve marked S, assumed to be an increasing function of the interest rate. The intersection of curves S and D determines the quantity of capital put in place, K_0 , and the interest rate, r_0 .

The effects of imposition of capital income taxation can be represented as a downward shift in the demand for capital, to curve D1 (the after-tax net marginal product of capital). The proportional distance between corresponding net marginal product curves before and after tax reflects the magnitude of the effective tax rate. This shift causes, as a

partial effect, a reduction in the interest rate to r_1 , and in the capital stock to K_1 . The rate reduction will be larger and the capital stock reduction smaller, the more insensitive is saving to the interest rate.

More Than One Type of Capital

The analysis becomes more complex when there is more than one type of capital--for example, equipment and structures--and, correspondingly, more than one effective tax rate. This case is presented in Figure 6, which shows the determination of the interest rate and the allocation of capital in a world in which there are two types of capital. In this discussion it will be assumed for simplicity that the supply of saving is insensitive to the interest rate. The fixed total stock of capital, which is represented by the distance of the saving-supply curve from the vertical axis in Figure 5, is instead represented as the width of the graph in Figure 6.

TABLE 10. ESTIMATED EFFECTIVE TAX RATES AND ECONOMIC DEPRECIATION RATES ON DIFFERENT TYPES OF CORPORATE CAPITAL BEFORE AND AFTER IMPLEMENTATION OF THE TAX REFORM ACT (In percent)

	<u>Effective Tax Rates</u>		Depreciation Rates
	Old Law	Tax Reform	
Equipment	4.5	37.3	14.1
Structures	41.7	44.2	3.4
Public Utilities	32.7	43.8	3.0
Inventories	47.7	43.4	3.0 ^a
Land	49.6	45.4	0.0

SOURCE: Yolanda Henderson, "Lessons from Federal Reform of Business Taxes," *New England Economic Review* (November/December 1986), p. 16.

- a. Henderson uses a depreciation rate of 0.0 for inventories, in contrast to the value shown here. A higher value was assumed in this study to take account of the possibility that inventories are subject to obsolescence over time.

Figure 5.

Effects of Capital Income Tax in Closed Economy
with One Asset

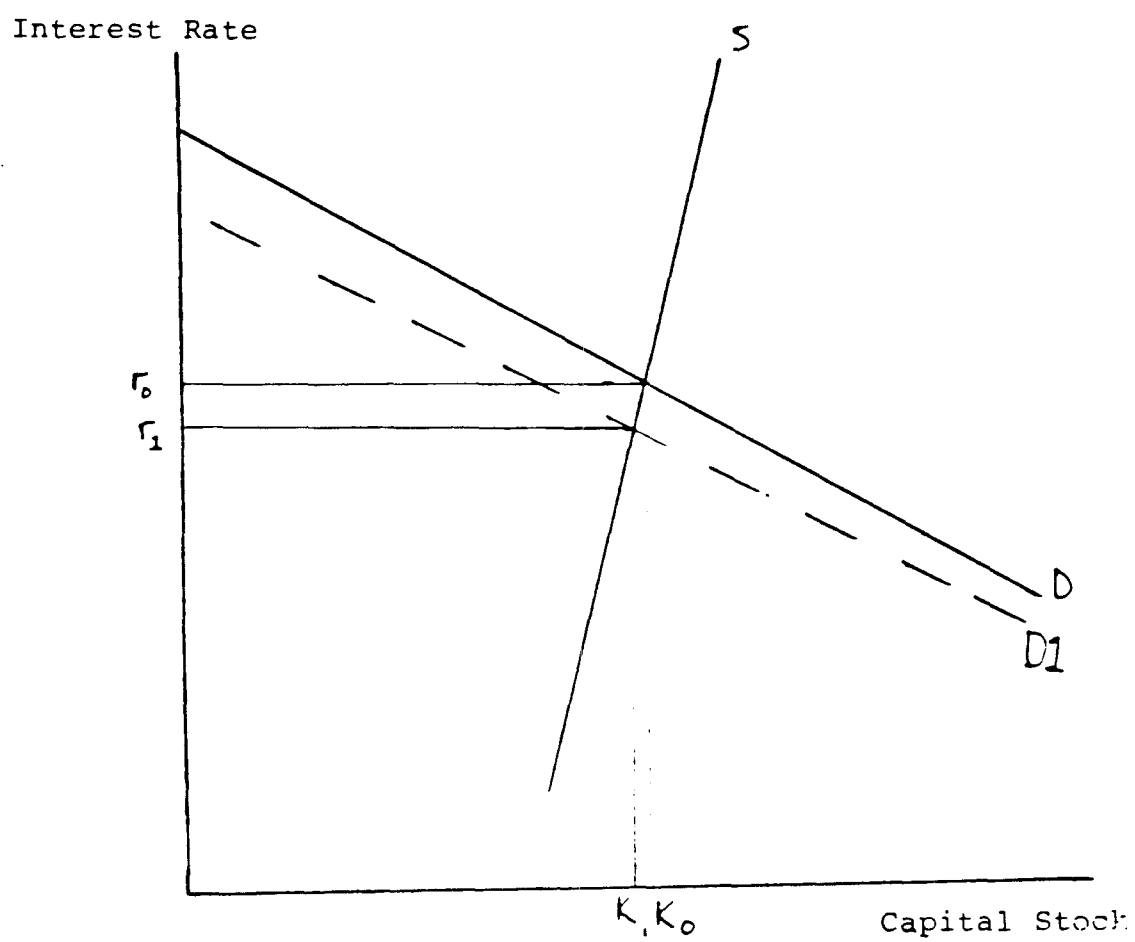
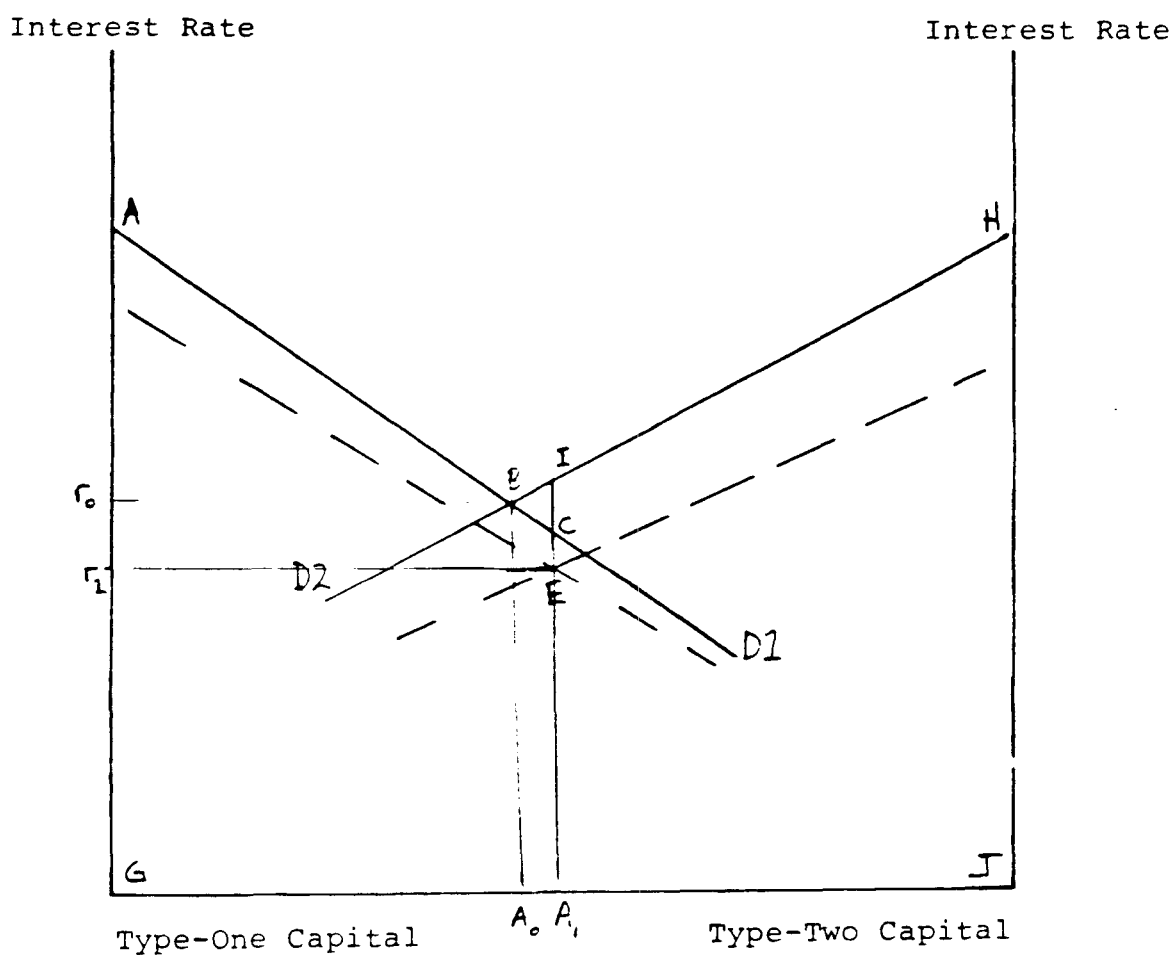


Figure 6.

Effects of Nonneutral Capital Income Taxes in Closed Economy with Two Assets



The demand curve for capital of type 1 is shown as the curve marked D1, with the quantity of that type of capital increasing from left to right. The demand for type-2 capital, the quantity of which increases from right to left, is shown by curve D2. The total available stock of saving must be invested in one or the other type of capital. If there are no taxes, this means that the allocation, A_0 , occurs where the two demand curves intersect. The interest rate, r_0 , is given by the ordinate of this intersection.

When there are taxes on the income from the two types of capital, they are reflected, as in Figure 5, by separate lines lying below the two capital-demand curves, representing the after-tax net marginal products of the two types of capital. The new interest rate r_1 and allocation of the capital stock, A_1 , are determined by the intersection of the two lower after-tax marginal product curves--point E in the graph. As Figure 6 suggests, higher capital income-tax rates are likely to reduce the interest rate, just as in the one-asset case.

If saving contracts with lower interest rates, one can imagine the width of the whole graph in Figure 6 contracting after the tax change and the interest-rate decline that it brings about. The contraction, however, forces the two after-tax net marginal product curves to intersect at a higher level--that is, at a higher interest rate. In the case of an infinitely elastic saving function, the interest rate will be restored by this process to its initial level. An infinitely elastic supply of capital from abroad, in particular, is one of the defining conditions of a "small" open economy. Neither the supply of private domestic saving nor of capital from abroad is likely to be highly elastic in the U.S. case, however, so that the interest rate is likely to fall somewhat as a result of tax reform.

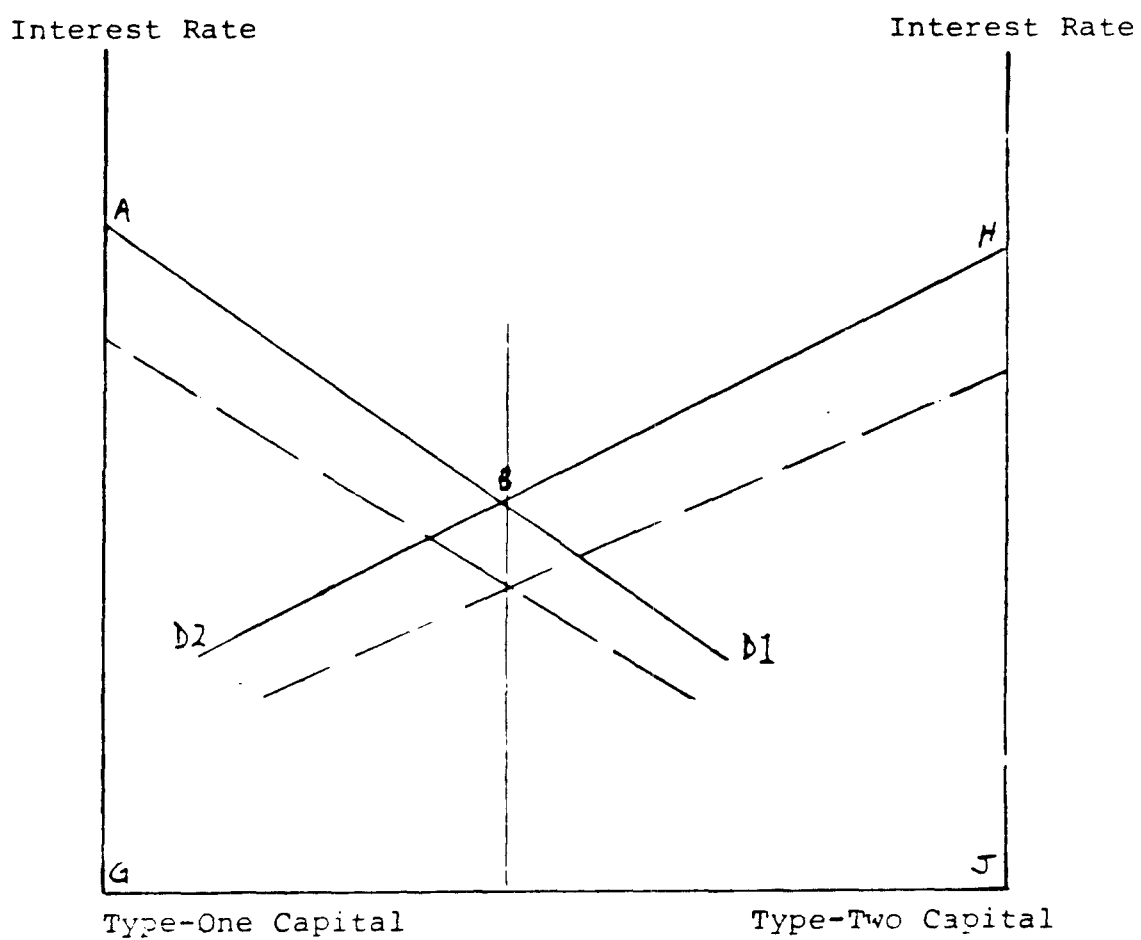
Efficiency Aspects

It is easy to demonstrate, using a graph like that in Figure 6, that a change in effective tax rates on different types of capital which makes these tax rates more equal leads to an increase in the total output produced by the two types of capital together--assuming that the tax change does not bring with it a change in the total amount of capital. This is shown by Figure 7 in comparison to Figure 6. Tax rates in the latter are quite unequal while in the former they are equal. Total output in the former case is the area ACIHJG while in the latter it is ABHJG. This is greater than ACIHJG by the area of the triangle BIC.

This demonstration is quite general, and it shows the virtues of a "neutral" tax code--that is, one that subjects different assets to equal effective tax rates. Equal effective rates mean that the two after-tax net

Figure 7.

Effects of Neutral Capital Income Taxes in Closed Economy with Two Assets



marginal product of capital curves intersect exactly below the intersection of the before-tax curves. This in turn results in an allocation of capital between the two types that equalizes net marginal products of capital before taxes--the point at which total before-tax production is maximized.

Open-Economy Aspects

Changes in the U.S. interest rate caused by the tax change may stimulate flows of saving into or out of the country. If the interest rate falls, capital may flow out. These possibilities are illustrated in Figure 8. Like Figure 5, Figure 8 assumes a single asset; as before, curve S is the supply of capital from domestic saving and curve D is the after-tax marginal product of capital located in the United States. The initial interest rate in the rest of the world is r_R . Curve R shows how the net supply of capital to the U.S. from the rest of the world responds to differentials between the U.S. interest rate and r_R ; curve S+R is the horizontal sum of S and R. The intersection of S+R and D determines the U.S. interest rate, r_{US0} and domestic capital stock. Although the total domestic capital stock is K_0 , only K_{US0} represents wealth to the United States.

For the case shown, the U.S. interest rate is assumed to lie above the world rate. In conventional "small-economy" models the external supply of capital is assumed to be infinitely elastic with respect to the interest-rate differential for assets of a given degree of risk. In such cases, both R and S+R would be flat, pegging the U.S. interest rate at the world level. Because the country under study is assumed in those models to be small, moreover, this interest-rate level would be invariant to tax changes and other developments in that country. Since the United States is not a small economy, this case is not assumed here.

An increase in capital income taxation in the United States shifts curve D downward to D1. With the elasticities assumed in the figure, this reduces the U.S. interest rate to r_{US1} , reduces U.S. wealth slightly to K_{US1} , and reduces total domestic capital to K_1 by inducing a capital outflow. As the graph suggests, the presence of a relatively interest-elastic supply of saving from the rest of the world means that the decline in the interest rate is likely to be smaller than it is in a closed economy.

One effect of the capital outflow is to reduce domestic product--the output of all capital located in the United States. The decline in U.S. national product--the output of all U.S.-owned capital, or in this case U.S. wealth--is much less, however. This difference mirrors the fact pointed out